large hatch. The pump, filter, cooler, and distributing manifold are grouped on the floor near by.

In operation, oil is supplied at the rate of 12 gallons per minute to the distributing manifold, from which it flows into the supply lines and to the various nacelle units. After flowing through the units it drains into the collection piping and is returned to the storage tank. The latter is vented to the tunnel so that flow conditions are independent of tunnel pressure. In each supply line near the nacelle unit a teleflow meter is installed. This is a device which prevents operation of the main drive motor whenever oil flow is not established.

A temperature indicator and thermoswitch are mounted in the case of each roller bearing at a point where they are in contact with the outflowing oil. The temperature indicator gives a remote reading at the console in the control room. The thermoswitch stops the main drive motor if the oil temperature exceeds 190 degrees *F*.

COOLING AND DEHYDRATING

THE cooling specifications of the Cooperative Wind Tunnel call for continuous operation of the equipment at a power input of 12,000 *hp*, with the temperature of the air inside the tunnel limited to about 125 degrees *F*. The radiator, which removes the corresponding amount of heat, *i.e.*, about 500,000 *B.t.u.* per minute, shown in *Fig. 14*, is located in the fourth wind tunnel corner just upstream of the contraction. It consists of 80 units of finned copper coils, each coil having three rows of tubes in depth.

In order to insure the smallest possible pressure drop across this radiator, it was placed with the tubes running parallel to the plane of the corner ellipse. The corner vanes, similar to those shown in *Fig. 6*, turn the air by only 45 degrees; thus the air arrives normal to the radiator face and is turned by an additional 45 degrees, completing the full 90 degree turn, on leaving the radiator. This final turn is achieved by means of small turning vanes that are integral parts of the radiator fins. The radiator coils are provided with water circulation entering and leaving through the tunnel corner vanes. The water is cooled by circulation over a cooling tower. About 3,600 gallons per minute of cooling water can be circulated in this system.

Recently it has become known that the relative humidity of the air is one of the important parameters of high speed flow. Furthermore, any appreciable accumulation of moisture would cause considerable inconvenience and complications. Therefore, it became advisable to control the humidity of the air inside the tunnel. This is done by means of a so-called dehydrator, an air

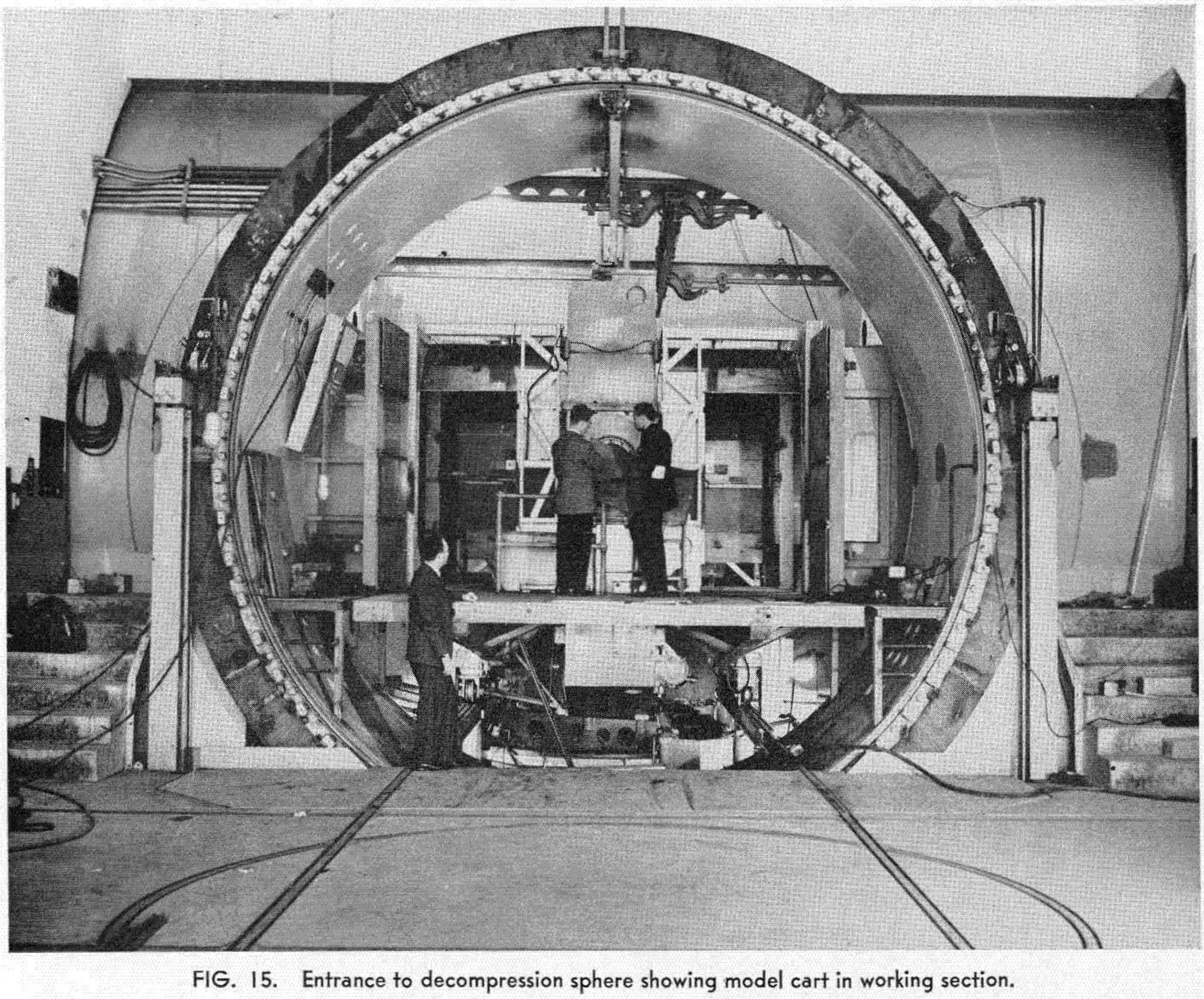

FIG. 15. Entrance to decompression sphere showing model cart in working section.

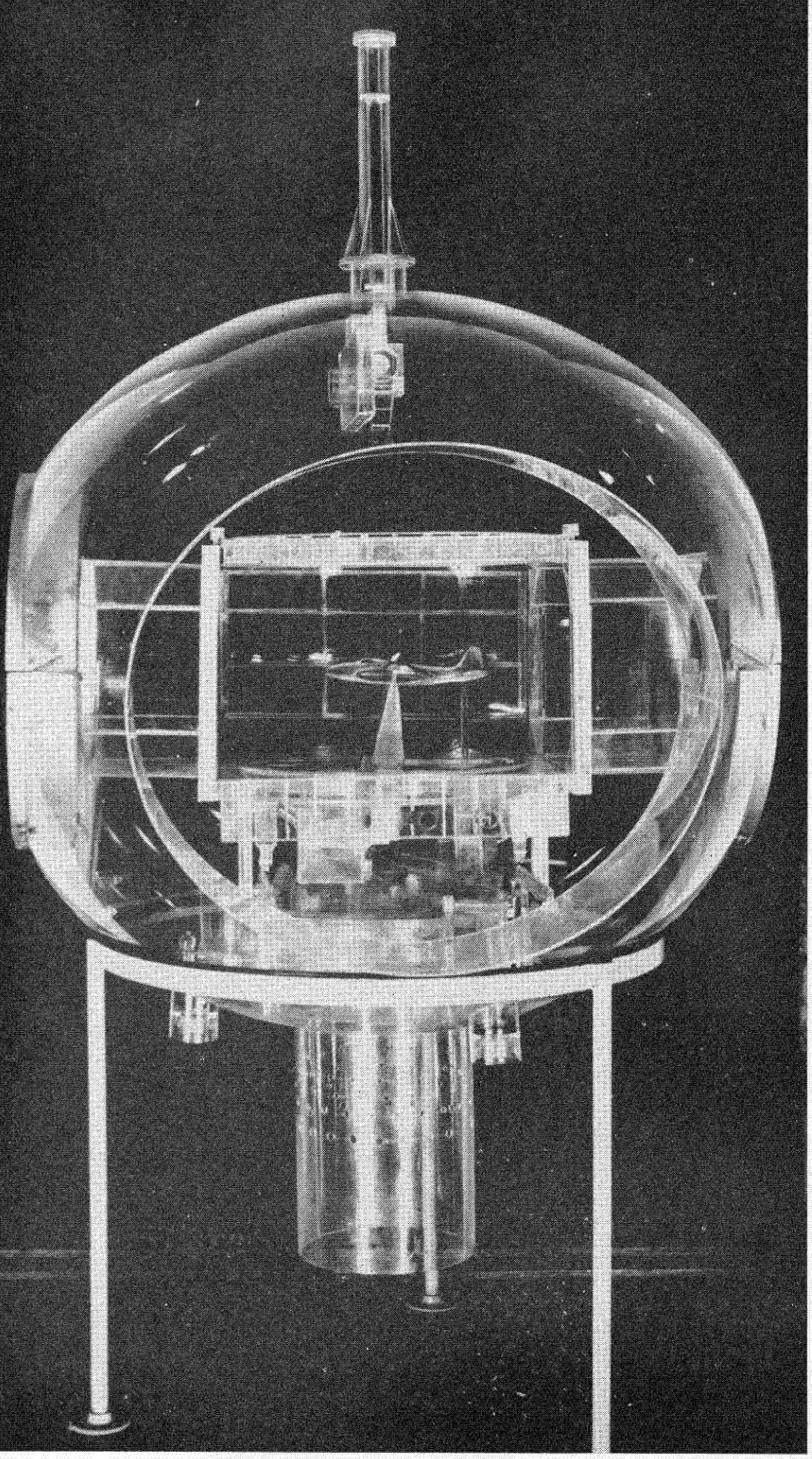

FIG. 16. View of plastic model of decompression sphere looking into the sphere through large door.

to brine heat exchanging coil which reduces the temperature of the air passing over it to about 40 degrees *F*.

The brine is cooled by ammonia, which is piped to the wind tunnel from the neighboring refrigerating plant of the California Consumers Corporation. During periods of shutdown, the tunnel air can be circulated through the dehydrator by means of a 3,000-*cfm* circulating fan. Furthermore, all fresh air entering the tunnel through the air compressors also passes over the dehydrator before entering the tunnel.

WORKING SECTION

THE working section of the Cooperative Wind Tunnel, having a cross-sectional dimension of 8½ by 12 feet, is located within a steel sphere 31½ feet in diameter, shown in *Fig. 15*. This sphere is essentially an air lock to permit access to the working section without disturbing all of the air in the steel duct of the tunnel, which contains some 185,000 cubic feet of air. It is frequently necessary to service the high-speed motors in the model, or to adjust delicate recording devices. Should the tunnel be under pressure at the time, it would require several hours to release this pressure and compress the air to its original testing pressure after adjustments had been made. A plastic model of the sphere and working section were constructed as shown in *Figs. 16, 17, and 18*.

With the large decompression sphere, less than one-tenth of the air inside the tunnel need be released, and the operators can work on the model at normal atmospheric pressure. The time required to close off the sphere, reduce it to atmospheric pressure, change or adjust the model, and prepare for testing at the original pressure is approximately seven minutes. Other tunnels exist where the operators may enter the pressurized area through a small air lock, but there is constant danger of severe discomfort should the body be subjected to sudden changes in pressure. The tunnel is pressurized with three air compressors located in the power house. About three and one-half hours are required to bring the pressure in the tunnel up to about 45 pounds per square inch.

The decompression sphere is provided with a massive steel door 19 feet in diameter, shown in the partially closed position in *Fig. 19* and completely closed in *Fig. 20*. Two large gate valves are provided at the entrance and exit of the working section, which seal off the sphere and working section from the pressurized tunnel. The entrance to the working section from the tunnel is shown in *Fig. 21*. The opening downstream is shown in *Fig. 22* with the gate valve completely open. The gate valve completely covers this opening when model changes are to be made during operation. *Fig. 23* shows the valve starting to close.

The models to be tested are mounted on large steel tables or carts, which can be rolled into or out of the sphere on steel tracks when the main door is open. *Fig. 24* shows one of these tables in position, ready for entrance into the sphere. The table is then rolled into the sphere and into position as shown in *Fig. 25*. The steel cart or table is then lowered into place by mechanical arrangement. The model supports rest on oil pads and their motion is restrained by devices to be described in more detail later. The multiple plugs to the recording devices, previously arranged on the table, are connected directly with the sensitive indicators and gages in the control room. After the suitable adjustments have been made, the large door to the decompression sphere is closed and the gate valves into the tunnel are opened; the unit is then ready for operation.

As indicated in the next section, three types of model supports are provided. While a test is being conducted, using one table, models can be installed for testing on the other tables outside the tunnel. When tests on the first model are completed, the table or cart is rolled out of the tunnel, the second is moved in, and the next test is ready to proceed. The use of the multiple model table saves hours or even days of tunnel time whenever a new model is tested. Furthermore, it is of interest to note that these tables or carts can be run into one of the model shops, where mounting of the models can be done behind drawn curtains. This provision makes it possible for different companies to have models at the wind tunnel simultaneously and still maintain the desired security.